



## **A REPORT ON**

### **RECONNSSANCE SURVEY OF** **DEVIPADAHARA AND PAPANASINI KUND,** **BHUBANESWAR**



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Life Link Eco Technologies Pvt. Ltd.

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## **1. BACKGROUND**

As directed by the MD, OBCC, an official visit was organized on 25<sup>th</sup> October, 2021 to explore the feasibility of renovation of Devi Padahara kund and Papanasini Kund near Lingaraj temple premises.

We were accompanied by OBCC officials represented by Mr Rakesh Panda, Mr Rashmi Ranjan Sahoo and his colleague.

We visually surveyed possible locations, space availability for any possible interventions we propose to set up on site.

We have prepared a protocol for water body rejuvenation specific to these two kunds for providing lasting, environmentally sustainable, robust and aesthetic solutions.

With inputs from Mr Rashmi Ranjan Sahoo we have collated the basic data in terms of dimensions of both tanks, basic hydrology data such as ground water table history of the area and a tentative drawing / sketch of kunds and surrounding free space to begin with.

The findings of preliminary reconnaissance survey have been documented here in this document and the scope for detailed survey has been highlighted.

## **2. OBJECTIVES OF DETAILED SURVEY**

- a) To ascertain the current status of Devi Padahara kund and Papanasini Kund with respect to both qualitative and quantitative aspects of water resource.
- b) To observe the groundwater table, existing recharge and discharge pattern (if any) for natural rejuvenation of the Kund.
- c) Source of contamination of water body if any.
- d) Ascertain the type and level of contamination.
- e) Study the Limnology of the water body.

f) To draw an action plan for eventual renovation work and prepare the DPR for the same..

### **3. MAJOR FINDINGS OF PRELIMINARY RECONNAISSANCE SURVEY**

The findings of the reconnaissance survey have been listed here in this section. However, complete survey and detailed investigation to prepare the strategy for restoration shall be required and the same shall be conducted in future as a part of this work. The basic information gathered in this trip has been compiled here in this report.

#### **A) PAPANASINI KUND: (Illustrated in Appendix A 5, Plate 1-5)**

The approximate dimension of the Kund is 41m x 30 m.

Average Depth of water table during the time of visit is estimated to be 4.0m (Illustrated in Plate- These Figures need to be ascertained during detailed survey.

#### **B) DEVI PADA HARA KUND: (Illustrated in Appendix A 5, Plate 6-9)**

The approximate dimension of the kund is 59.10m x 43.0 m.

Average Depth of water table during the time of visit is estimated to be 4.0m

These Figures need to be ascertained during detailed survey.

The normal annual rainfall at Bhubaneswar is recorded to be 1449.1mm & the annual average rainfall is 1436.1mm.

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The precipitation rate of Bhubaneswar city indicates that there is ample scope for recharging the water bodies every season during regular monsoon period.

Both the water bodies were covered with duckweeds and water hyacinth (in Papanasini kund). There was an ample fish / aquatic life population in both the kunds..

Though water body is now filled up, as per locals it gets dried up during peak summer.

The photograph (Plate- 3, 4 & 6) attached shows the water level of the kund during the visit (25<sup>th</sup> October 2021) and infestation with water hyacinth.

Soil strata study through geotechnical survey shall conclusively determine loss of water due to permeability of soil.

The area around the Kunds was surveyed. The area available near the entrance of **Devi Pada hara Kund** and along the periphery is adequate for setting up a Vertical Garden type natural treatment system (Based on Advanced Soil Biotechnology)

The area at one corner of the **Papanasini Kund** has been found to be available for construction of natural water treatment Plant.

#### **4. OUR APPROACH TO THE PROBLEM**

The holistic approach proposed by us is aimed at designing a systematic protocol specific to the renovation of this particular kund as per our observations during the reconnaissance survey. The protocol is aimed at restoration of perennial status of the water body, conservation and maintenance of water quality by natural and sustainable means. The proposed design also recognizes the fact that periodic chance of contamination due to recreational public use, atmospheric pollution, contaminated groundwater / surface water recharge source etc. is unavoidable. Therefore, a robust and sustainable system should be put in place for operational sustainability of the scheme. The protocol for Kund renovation is designed accordingly and the same is summarized in Appendix 1.

It is hereby proposed to address the multiple angles related to issues of rejuvenation in a phase wise manner as outlined below.

In phase 1 administrative clearance shall be obtained for permission to carry our activities in and around the kund necessary for Kund renovation. Necessary security arrangement for the storage of tools and instruments must be put in place. At present there is no protective fence around the Pond which allows free public/ stray animal access. This work of Phase 1 shall be within client scope.

In phase 2, detailed survey of various parameters of the kund eco system shall be conducted to verify the assumptions made in the just concluded reconnaissance survey and strengthen decision making process before we propose the final strategy for the kund rejuvenation. This will be within the scope of LIFE LINK

In phase 3 the technical interventions proposed in phase 2 shall be implemented. The scope of work shall be within scope of LIFE LINK/ OBCC appointed contractor. The renovated kund post implementation shall be monitored for a period of 1 month before handing over to authority/ agency appointed by custodians of the Kund.

The data collected from phase 3 operation shall be compiled and the same information may be used for design of SOP/ Protocol/ Master Plan for all Heritage Kunds of Bhubaneswar

## **5. ACTION PLAN**

### Phase 1: Administrative

Understanding the ownership/custodian of the site from respective civic body in charge of the above Kunds administrative clearance is needed for some type of physical intervention that may be required for the purpose of water body rejuvenation.

Access to Survey Map of the Kund as per revenue record and access to surrounding land area which may be necessary for any physical structure that might be needed to set up permanent natural water treatment system.

Setting up Security infrastructure for protecting the equipment and installations during kund renovations work and thereafter.

Fencing the area and prevent public access during the course of project execution.

### Phase 2: Investigative

A protocol for the systematic investigation required, analysis of the results, proposed intervention etc. are summarized in flow chart shown in Appendix 1. The details are as follows

- A) Monitor water quality of the Kund water for specified parameters. (Online/off line)
- B) Soil geotechnical characteristics of the soil at bottom of the lake and the surrounding area of the kund. Study of Silt geochemistry to ascertain contamination level of bottom soil.
- C) Design of Physical intervention such as construction of hydraulic structures such as silt trap and intake well/recharge
- D) Hydrology of the area around the Kund: Investigation of Groundwater table status (to ascertain surface water impounding and recharge technique vis-a-vis Groundwater recharge technique to be adopted for rejuvenation of the kund.

E) Study of limnology of the water body both microscopic and macroscopic characteristics.  
Ascertain the pollution level with respect to indicator organisms.

Estimated Budget for Phase 2: TO be determined post detailed survey.

Detailed Scope in Section 6 & 7.

### Phase 3: (Anticipated Interventions)

- A) Construction of surface water intake chamber for recharge of water body.
- B) Lining of Pond with natural clay liner. (Post Phase wise dewatering), geotextile protective layer and sand bed laying.
- C) Construction of Pond water recycle system based on Advanced Soil Bio Technology for periodic cleaning of water body and maintain potable water quality standard throughout. This will be a permanent and robust fallback option for addressing all possible chances of contamination as an immediate and need based manner. (Appendix. 5)
- D) Dosing of catalyst/ culture for immediate rejuvenation of water quality and desludging of the lake bottom surface.
- E) Monitoring of water quality for 3 months via online and subsequently one sample per month off line.
- F) Construction of concealed storm water drainage system and Greenery development around the water body for preventing surface run off intrusion and development of aesthetics.

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Estimated Budget: (Details in Section 6 and 7).

## 6. Budget Estimate (Capex)

<u>PHASE 1</u>			
<u>ADMINISTRATIVE</u>			
<u>SL No</u>	<u>Job Description</u>	<u>Unit Rate, INR</u>	<u>Amount, INR</u>
<u>1</u>	Compliances		
<u>2</u>	Permission		
<u>3</u>	Security		
<u>4</u>	Fencing for preventing public and stray animal access		
<u>5</u>	Travel, Lodging and Boarding expenses		
<u>6</u>	Total PHASE 1		<u>CLIENT SCOPE</u>
<u>PHASE 2</u>			
<u>DETAILED INVESTIGATION</u>			
<u>Investigation</u>			
<u>1</u>	Physical Characterization		
<u>2</u>	Geo technical		
<u>3</u>	Geochemical		
<u>4</u>	Ground water hydrology		
<u>5</u>	<b>Total</b>		
<u>6</u>	Chemical Characterization		
<u>7</u>	Online monitoring		
<u>8</u>	<b>Total</b>		
<u>9</u>	Biological		
<u>10</u>	Micro and macroscopic study of Flora/ Fauna		
<u>11</u>	<b>Total</b>		
<u>12</u>	Travels and incidentals		
<u>13</u>	Total PHASE 2		

<u>PHASE 3</u>			
<u>INTERVENTIONS</u>			
<u>1</u>	<u>Physical</u>		
	<b>Intake chamber with silt trap and invert filter (Surface recharge point) with gate operation</b>		
	<b>Bottom surface lining with natural material, 1500 sq.m</b>		
	<b>Dewatering (phase wise) with sand bag partition (If required)</b>		
	<b>Chemical</b>		
	<b>Water quality monitoring post installation of natural filtration system for 2 months</b>		
	<b>WTP based on Soil Biotechnology</b>		
	<b>Setting up 100 KLD capacity of Advanced Soil Biotechnology based STP with micron filter and water conditioner as required for the process</b>		
	<b>Biotechnological</b>		
	<b>Selection, isolation and development of Microbiological culture (aerobic and anaerobic) immobilized on carrier microorganisms for application in the pond and natural bio catalysts for in situ remediation of nutrients in water body and in the bottom sediment.</b>		
	<b>TOTAL PHASE 2</b>		

## **7. Budget (Recurring)**

**Recurring** cost will vary as per the operation timeline (**depending on the frequency and intensity of public usage**).

In case of Continuous on field operation and maintenance (i.e., plant is continuously running) the operation and maintenance (O&M) cost will be 60,000 Rs (excluding tax) per month. The O&M will include manpower, critical supervision, water testing (2 samples of inlet and outlet each month) and natural additive. The electricity bills, electrical and mechanical spares (at actual if and as required) will be in client scope.

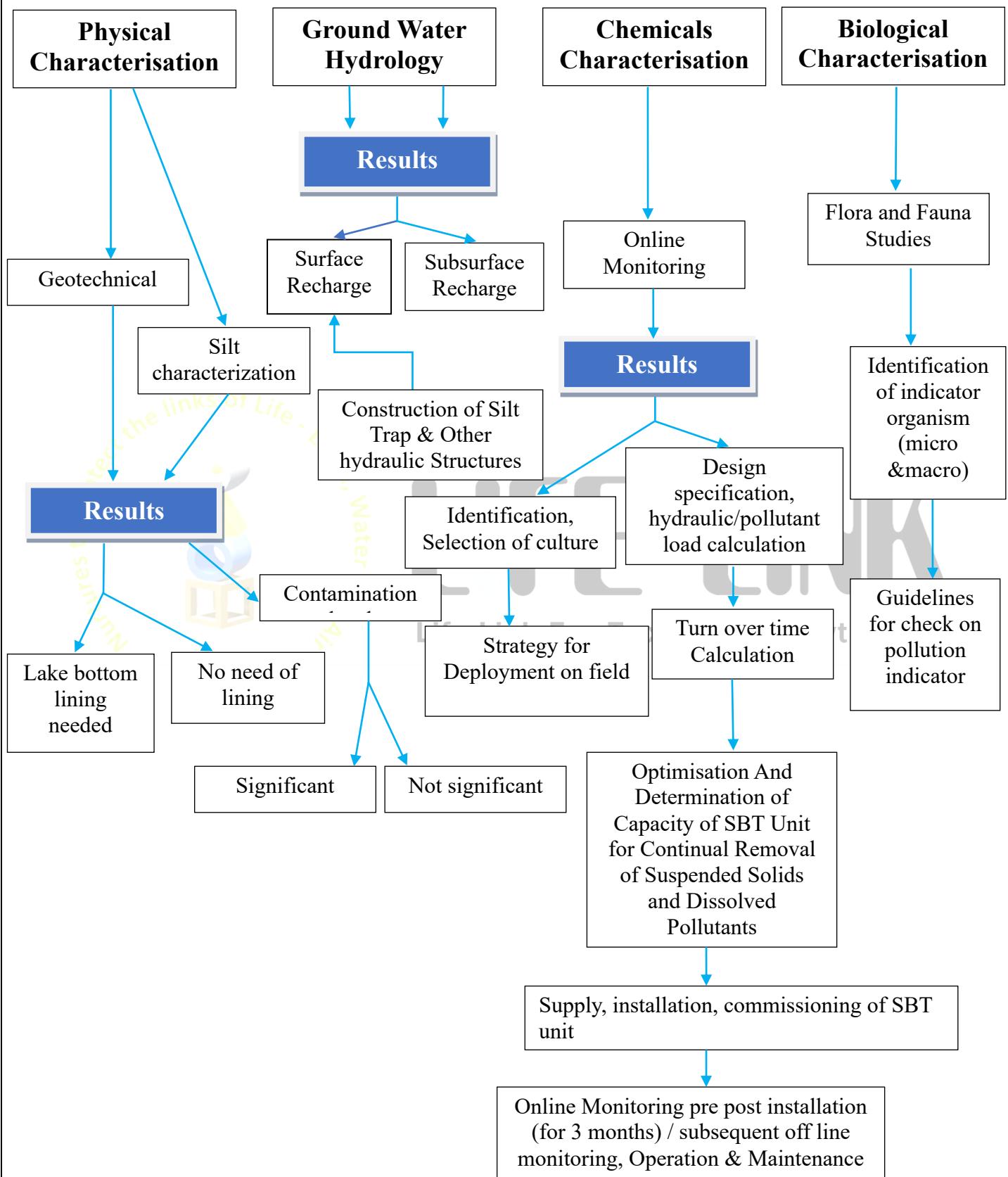
In case of off the field remote operation, the O&M cost will be **15,000** Rs per month (excluding tax). The scope will be limited to **one-time** water quality testing per month **and remote guidance**. **This excludes energy cost, consumable (need based) for periodic operation of the plant and watch and ward of the system/asset built on site.**

**Note: The information shared in this document is confidential and proprietary. The IP rights of the information solely belong to IIT Bombay. It is implied that any part of the information should not be shared with a third party/individual without our prior consent except to the party intended herein for institutionalization of the execution of the project.**



## 8. APPENDIX A : 1

### PROTOCOL FOR WATER BODY REJUVENATION



## **Appendix A 2: About LIFE LINK**

### **Life Link Eco Technologies Pvt. Ltd.**

Introduction to Life Link Eco Technologies Pvt. Ltd.:

- a) Life Link Eco Technologies Pvt. Ltd. is a for-profit green social business initiative founded in 2001. Life Link has also pioneered technology transfer, commercialization and outreach of Soil Biotechnology in India. IIT Bombay holds the Intellectual Property Rights (IPR) on Soil Biotechnology covered under US and Indian Patents Laws.
- b) Life Link offers sustainable solutions for wastewater treatment, water quality upgradation & water resource management and is focused on delivering Soil Biotechnology and Environmental Engineering Solutions for rural and urban waste recycling, sanitation and water quality improvement.
- c) Life Link has been conceived by a team from Indian Institute of Technology (IIT) Bombay with extensive background in Chemical & Environmental Engineering and is professed by people deeply committed to Ecology, Environment & Waste Management. The Life Link team had earlier set up and run the research arm with Indian Institute of Technology (IIT) Bombay & Soil Biotechnology (SBT) is a product of this team effort.
- d) The CEO & MD of Life Link is a co-author of the patent and has contributed significantly to development and commercialization of Soil Biotechnology.
- e) Soil Biotechnology based systems stand out as a cost-effective, indigenous solution to address the problem of management of wastewater and organic solid waste, specific to the Indian climatic, social and environmental scenario. Life Link's Soil Biotechnology Systems have a proven extensive track record of 20+ years operation in tropical conditions with users spanning the length and breadth of the country.
- f) Life Link's engineering and operations teams have gained 20+ years of knowledge and experience in plant design, project execution & have a strong reliable service support system operating Sewage Treatment Plants (STP) based on Soil Biotechnology.
- g) As an R & D driven company, Life Link continuously upgrades its service offerings.

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## **APPENDIX A 3**

### **Patents on Technology**

- a) US Patent No: 6890438 "Process for treatment of organic wastes" H. S. Shankar, B.R. Patnaik, U.S. Bhawalkar, issued 10 May 2005
- b) US patent No: 7604742B2; "Biofertilizers and Reusable Water", Issue Date of Patent: October, 20, 2009.
- c) "Process for treatment of Organic Solid Wastes" India Patent No. 203425 Granted on 01 Nov 2006 vide Application 384/MUM/2002 dated 26 Apr 2002, H.S. Shankar, B. R. Patnaik, U. S. Bhawalkar
- d) Process for Waste water Renovation" India Patent No. 203744 granted on 15 Nov 2006 vide Application 383/MUM/2002 26 dated April 2002, H.S. Shankar, B. R. Patnaik, U. S. Bhawalkar

### **Process for treatment of organic wastes**

#### **US Patent Number: 6890438 Issued on 10 May 2005**

Abstract: A process for conversion of organic wastes into biofertilizers such as soil conditioning agents of fertilizer grade, culture grade and soil grade is provided. Also provided is a process for conversion of organic wastes into material for converting waste water into reusable water. The invention provides methods for conversion of organic solid wastes to biofertilizers and reusable water in the presence of a geophagus earthworm *Pheretima elongata* culure to produce a variety of valuable soil conditioning products and reusable water.

### **Bio-fertilizers and Reusable Water**

#### **US patent No: 7604742B2 Issued on 20 Oct 2009**

Abstract: A process for conversion of organic wastes into biofertilizers such as soil conditioning agents of fertilizer grade, culture grade and soil grade is provided. Also provided is a process for conversion of organic wastes into material for converting waste water into reusable water. The invention provides methods for conversion of organic solid wastes to biofertilizers and reusable water in the presence of a geophagus earthworm *Pheretima elongata* culure to produce a variety of valuable soil conditioning products and reusable water.

### **Process of Treatment of Organic Solid Wastes**

#### **Indian Patent No. 203425, Granted on: 01-Nov-2006**

### **Process of Waste water Renovation**

#### **Indian Patent No. 203744, Granted on: 15-Nov-2006**

## **APPENDIX 4**

### **Description of Technology (Soil Biotechnology)**

#### **Soil Biotechnology (SBT) - An Executive Summary**

- a) Developed by Indian Institute of Technology (IIT) Bombay. U.S. and Indian Patent held by IIT Bombay. LIFE LINK is licensed to commercialize the technology.
- b) Zero discharge Technology
- c) An indigenous technology customized for India's tropical conditions.
- d) Minimal mechanization, hence almost zero-time Active materials used in process are from natural sources only; no use of synthetic man-made chemicals.
- e) Highly energy efficient as compared to conventional technology – ideal candidate for CDM / Carbon Credits
- f) No air and sound pollution
- g) Waste processing in an odor free environment
- h) Ideal for projects seeking Green Rating (LEED, GRIHA, etc.)
- i) Ideal for institutions (where pollutant load varies randomly from low to peak occupancy across the year) as the SBT system is unaffected by low load factor and can handle occasional shock loading. (By contrast, conventional systems operate at its best only at the design flow)
- j) Picturesque garden is the only 'by-product'.

#### **Application Areas of Soil Biotechnology (SBT)**

- a) Sewage / Effluent Treatment
- b) Organic solid waste processing in a garden / farm-like environment
- c) Green Toilets
- d) Drinking water quality improvement for Rural Communities

#### **Other Innovative SBT Applications**

- a) Polishing effluent from conventional treatment to meet discharge standards
- b) Industrial feed water quality upgradation
- c) Chlorine-free cleaning of swimming pools

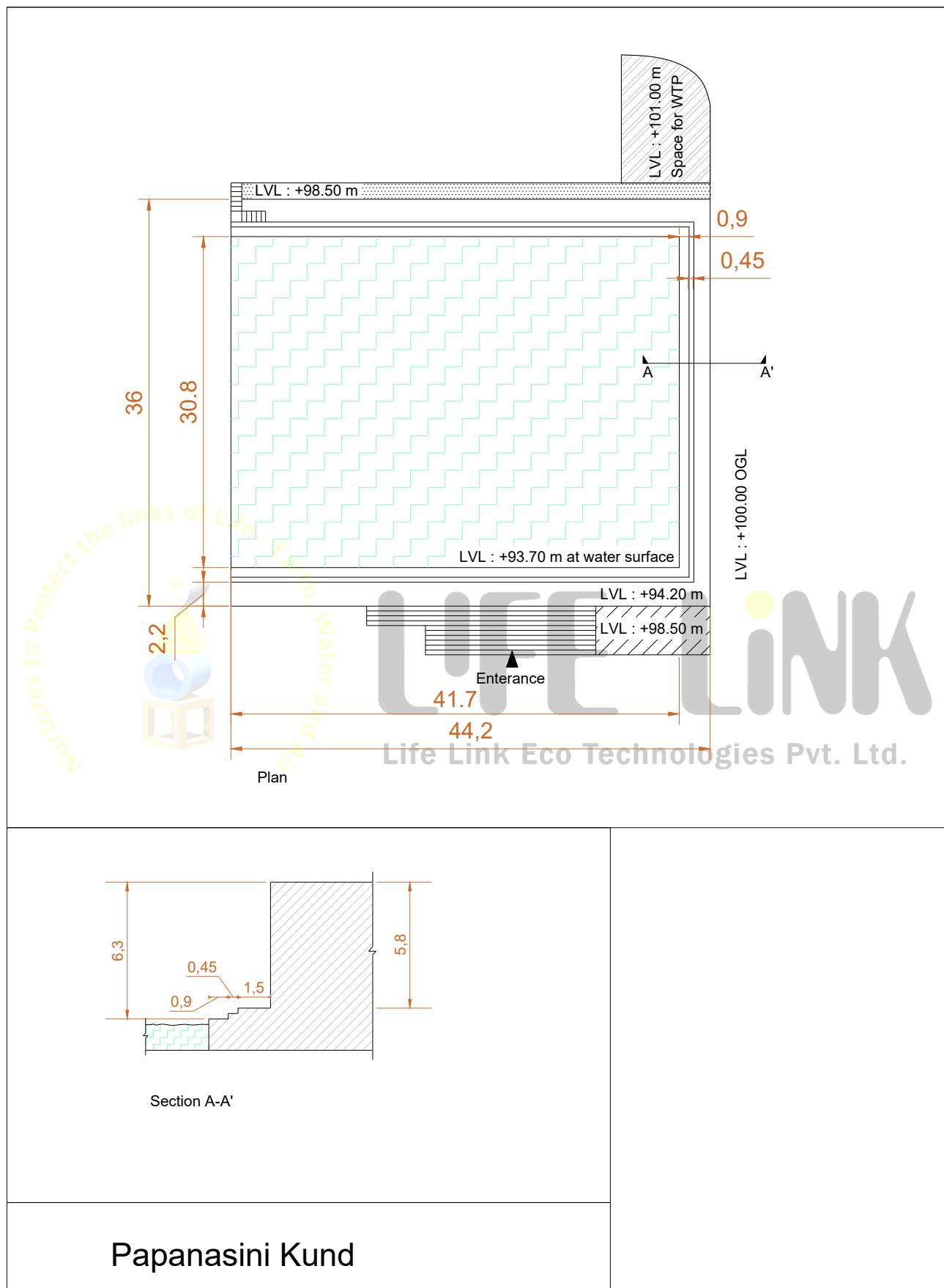
#### **SBT User Segments**

- a) Gated Communities (Residential Complexes, Educational / other Institutions, etc.)
- b) Corporate Houses, Industries, Software Parks
- c) Hospitals
- d) Dairies
- e) Shopping Arcades

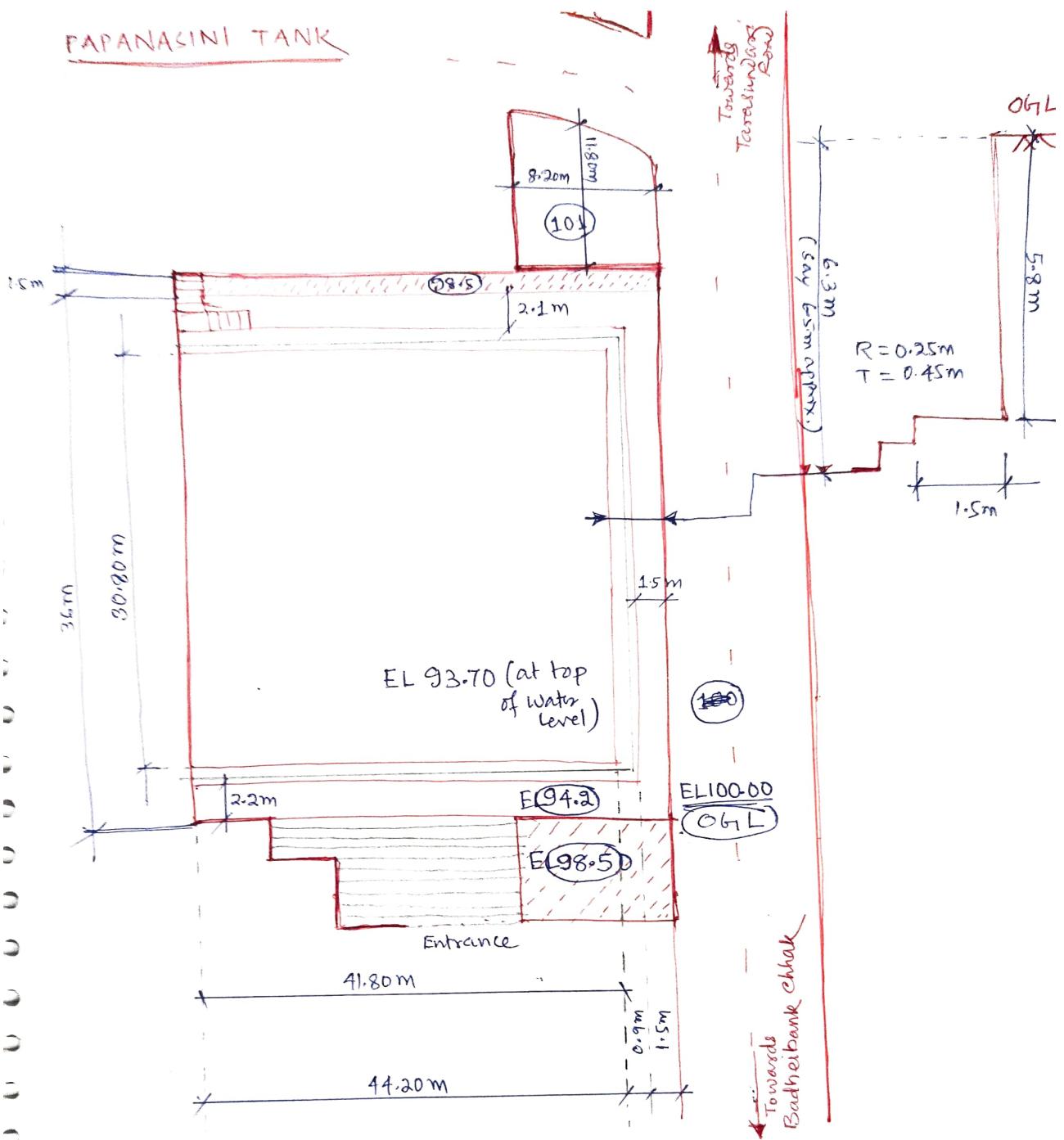
- f) Municipalities
- g) Rural Communities
- h) Farm Communities
- i) Airports & Railway Stations
- j) Independent Houses



## APPENDIX 5 (ILLUSTRATIONS)



## PAPANASINI TANK



Available depth of water = 10-12ft  
 MWL ~~18ft~~ = 18ft - 20ft  
 GWT = 35ft (from OGL)



PLATE 3: PAPA NASINI KUND: CURRENT STATE



PLATE 4: PAPA NASINI KUND: CURRENT STATE

Pvt. Ltd.



PLATE 5: PAPA NASINI KUND: AFTER RENOVATION  
(ARCHITECTURAL IMPRESSION)

vt. Ltd.



Structures to  
water and



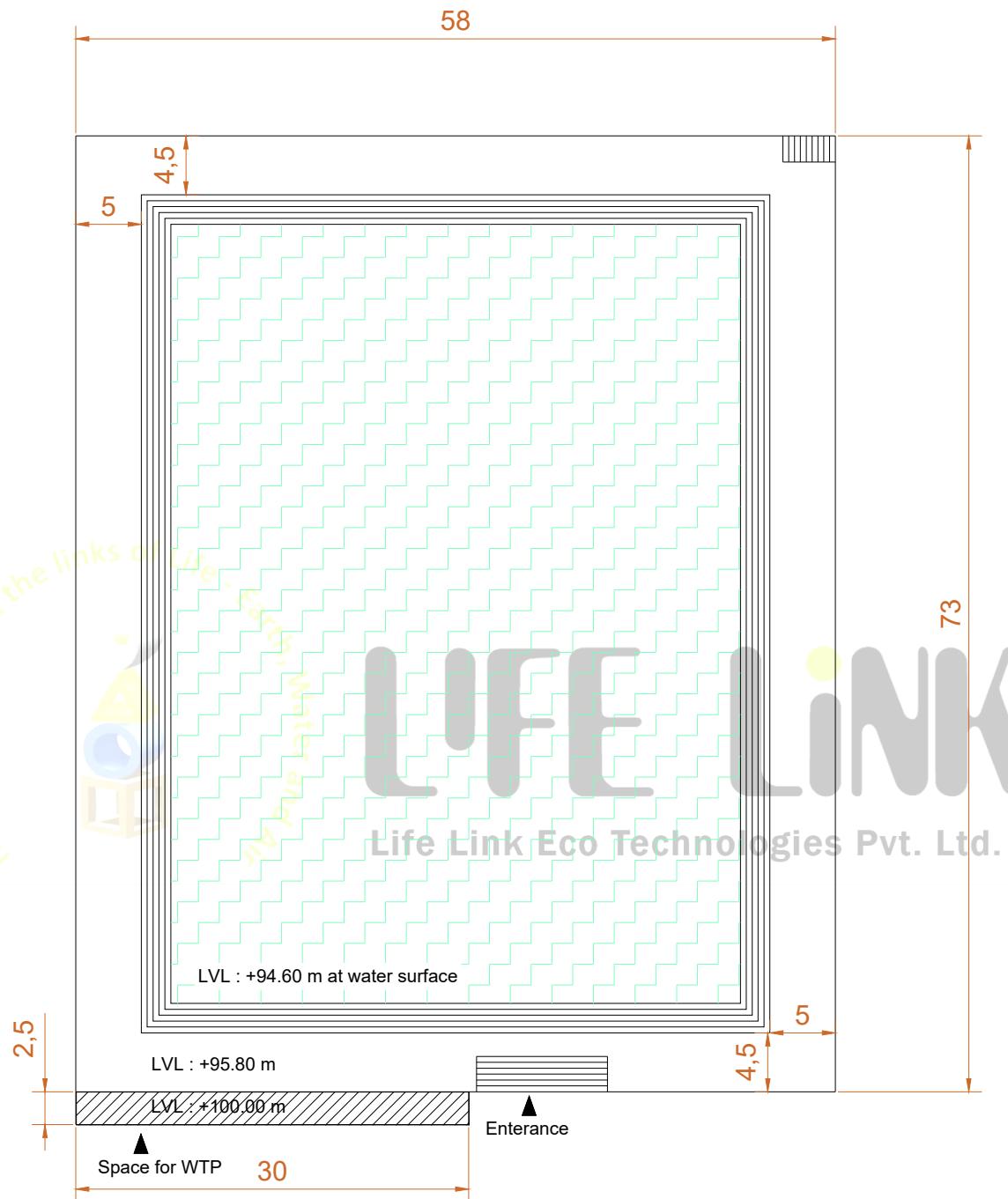
PLATE 6: DEVI PADA HARA KUND: CURRENT STATUS

.. Ltd.



PLATE 7: DEVI PADA HARA KUND: SPACE MARKED FOR WTP (VERTICAL GARDEN)

Measures to Protect the links of Devi Pada Hara Kund

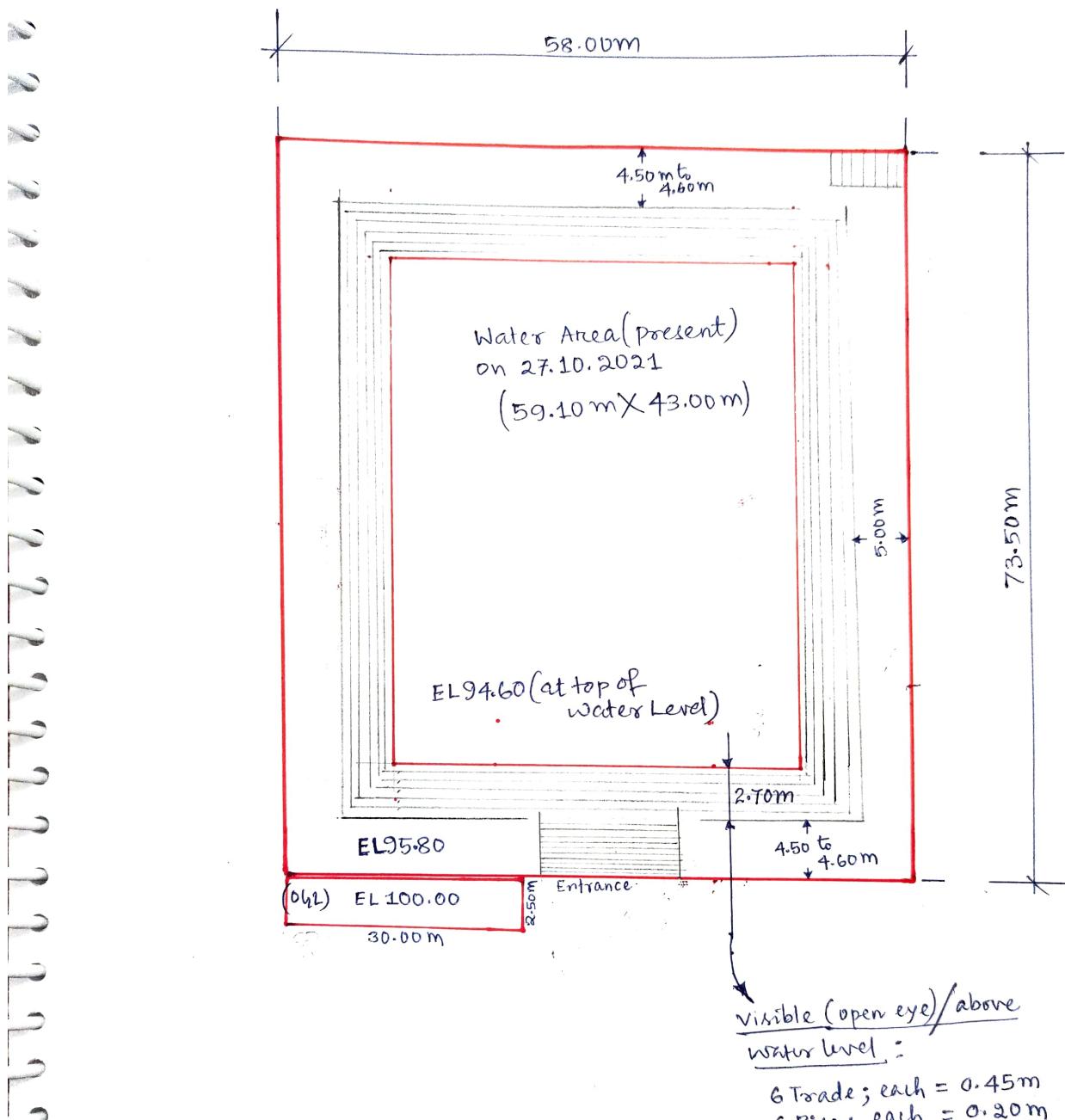


## Depipadahara Kund

PLATE 8: DEVI PADA HARA KUND: LAY OUT

## Depipadahara Pond

North



Available Depth of water = 12ft (approx.)

HFL =  $12 + 8 = 20$ ft (approx.)

GWT = 35ft (from 061)

PLATE 9: DEVI PADA HARA KUND: RECONNAISSANCE SURVEY DATA